

What is claimed is:

1. A molten bath testing probe comprising:  
a metal body having a pair of integrally formed sample receptacles for submersing into a bath of molten material and for holding a sample of the molten material;  
a temperature sensor received in each said sample receptacle; and  
an analyzer in communication with said temperature sensors for determining a difference between the temperature of molten material in the sample receptacles when the receptacles are submersed and the temperature at which the molten material begins to solidify after the body is removed from the bath.
2. The molten bath testing probe of claim 1, wherein said body comprises a central portion, said sample receptacles being positioned on opposing sides of said central portion.
3. The molten bath testing probe of claim 1, wherein each said temperature sensor comprises a thermocouple extending into an interior of said receptacle.
4. The molten bath testing probe of claim 3, wherein said thermocouples each comprise a calibrated K-type thermocouple.
5. The molten bath testing probe of claim 1, wherein said body is reusable.
6. The molten bath testing probe of claim 5, wherein the molten material comprises a cryolitic electrolyte.
7. The molten bath testing probe of claim 6, wherein said analyzer comprises means for determining freezing temperature of the bath.
8. The molten bath testing probe of claim 7, wherein said analyzer comprises means for determining superheat of the bath.

9. The molten bath testing probe of claim 6, wherein said body is made of steel.
10. A method of testing a bath of molten material comprising:
  - submerging a metal body having a pair of integrally formed sample receptacles receiving temperature sensors into a bath of molten material;
  - filling the sample receptacles with the molten material;
  - removing the filled sample receptacles from the bath;
  - measuring a first temperature of the molten material with the temperature sensors;
  - allowing the molten material to cool while measuring the temperature of the cooling molten material in order to determine a cooling rate thereof;
  - measuring a second temperature of the molten material when the cooling rate of the molten material changes; and
  - determining a difference between the first and second temperatures.
11. The method of claim 10, wherein the second temperature is measured at the liquidus temperature for the molten material.
12. The method of claim 1, wherein the bath of molten material is an aluminum smelting bath.
13. The method of claim 12, wherein the steps are each repeated using the same body.
14. The method of claim 13, further comprising reheating the cooled material and removing the reheated material from the sample receptacles prior to resubmersing the sample containers in the bath.
15. The method of claim 11, further comprising determining whether the bath of molten material meets predetermined specifications based on the difference between the first and second temperatures.

16. A molten material testing probe comprising:
  - a one-piece body for submersing into a bath of molten material comprising a sample receptacle for holding a sample of the molten material and a reference member comprising a reference material, wherein said sample receptacle and said reference are integrally formed in said body from a single material;
  - a sample temperature sensor received in said sample receptacle;
  - a reference temperature sensor contacting said reference material; and
  - an analyzer in communication with said sample temperature sensor and said reference temperature sensor for determining a difference between a temperature of the molten material in the receptacle and a temperature of the reference material.
17. The probe of claim 16, wherein said body is made of metal.
18. The probe of claim 17, wherein said metal is steel.
19. The probe of claim 18, wherein the molten material comprises an aluminum smelting bath.
20. The probe of claim 16, wherein each said temperature sensor comprises a thermocouple.
21. The probe of claim 20, wherein said thermocouples are calibrated K-type thermocouples.
22. The probe of claim 19, wherein said analyzer comprises means for determining whether the bath of molten material meets at least one predetermined specification.
23. The probe of claim 22, wherein the predetermined specification is selected from the group consisting of the concentration of alumina, the ratio of the amount of aluminum fluoride to the amount of sodium fluoride, bath superheat and combinations thereof.

24. A method of testing a bath of molten material comprising:  
submersing a one-piece probe body into a bath of molten material, the body having a sample receptacle for holding a sample of the molten material and a reference member comprising a reference material, wherein the sample receptacle and the reference member are integrally formed in the body from a single material, the sample receptacle receiving a sample temperature sensor and the reference member receiving a reference temperature sensor contacting the reference material;

filling the sample well with the molten material;

removing the probe body from the bath; and

allowing the molten material and the reference material to cool while measuring a temperature of the cooling molten material and a temperature of the cooling reference material and determining a difference between the temperature of the cooling molten material and the temperature of the cooling reference material.

25. The method of claim 24, wherein the bath of molten material is an aluminum smelting bath.

26. The method of claim 25, wherein the steps are repeated using the same body.

27. The method of claim 26, further comprising reheating the cooled material and removing the reheated material from the sample receptacle prior to resubmersing the sample container in a bath of molten material.

28. The method of claim 25, further comprising determining whether the bath of molten material meets predetermined specifications based on the temperature difference for at least one molten material temperature.

30. The method of claim 29, wherein the predetermined specifications are selected from the group consisting of alumina concentration, ratio of aluminum fluoride concentration to sodium fluoride concentration, bath superheat and combinations thereof.